SANYO

Service Manual

Ultra-Low Temperature Freezer

MDF-794

MDF-793(N)

MDF-794C

SANYO Electric Co., Ltd.
Biomedical Business Division

RoHS

This product does not contain any hazardous substances prohibited by the RoHS Directive.
(You will find 'RSF' mark near the rating plate on the RoHS compliant product.)

WARNING

* You are requested to use RoHS compliant parts for maintenance or repair.
* You are requested to use lead-free solder.

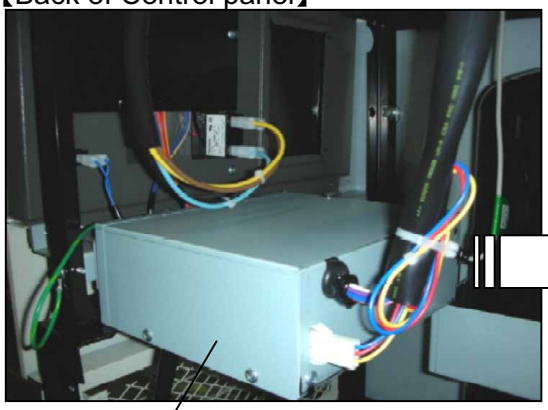
SM9910121

Parts layout

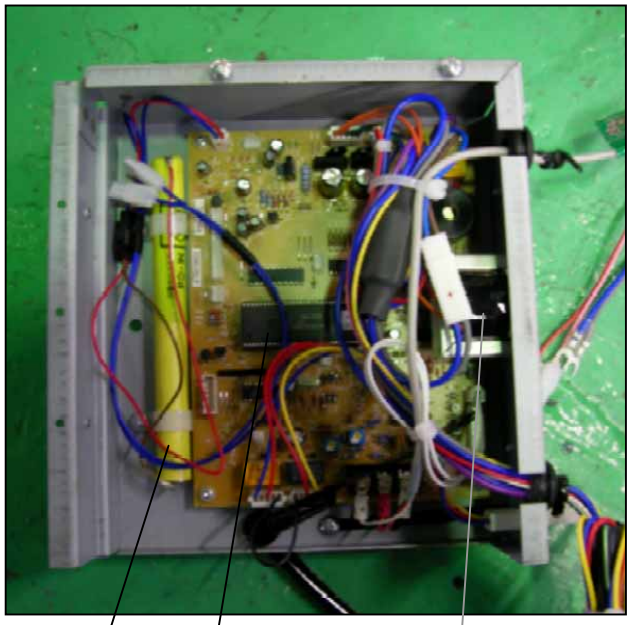
【Upper right corner - Front】

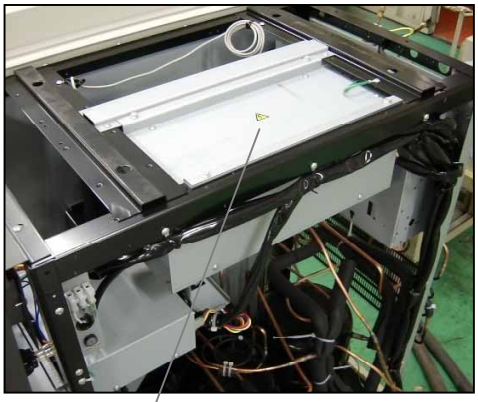
【Right corner - Front】

【Back of Control panel】

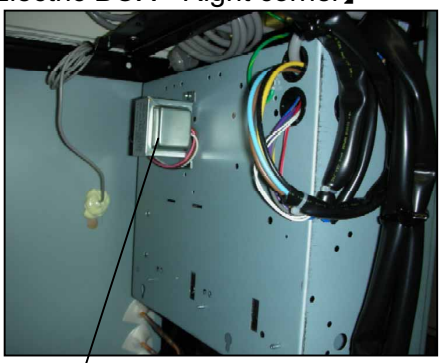


【Control PCB BOX】



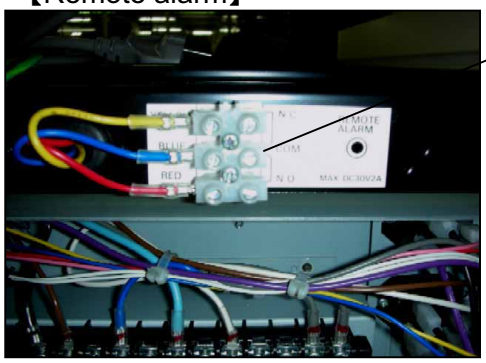


【Electric BOX - Right corner】

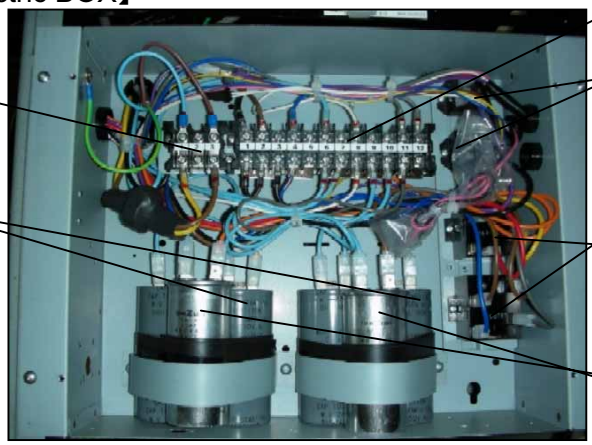


Transformer

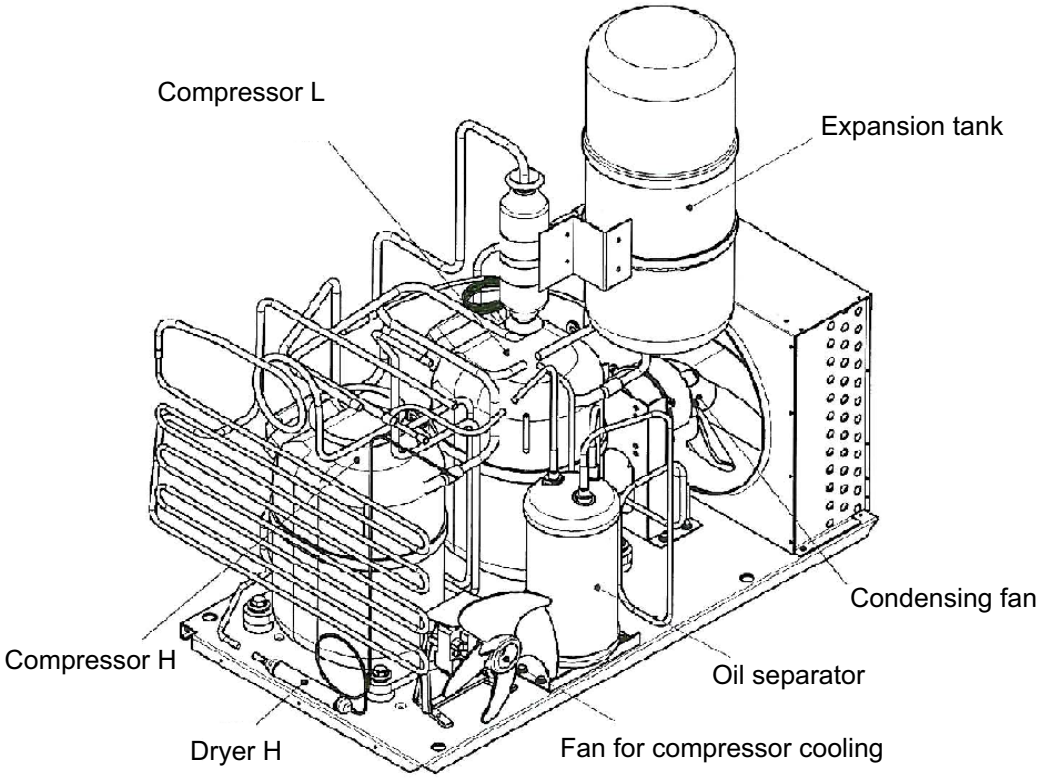
【Remote alarm】



【Electric BOX】

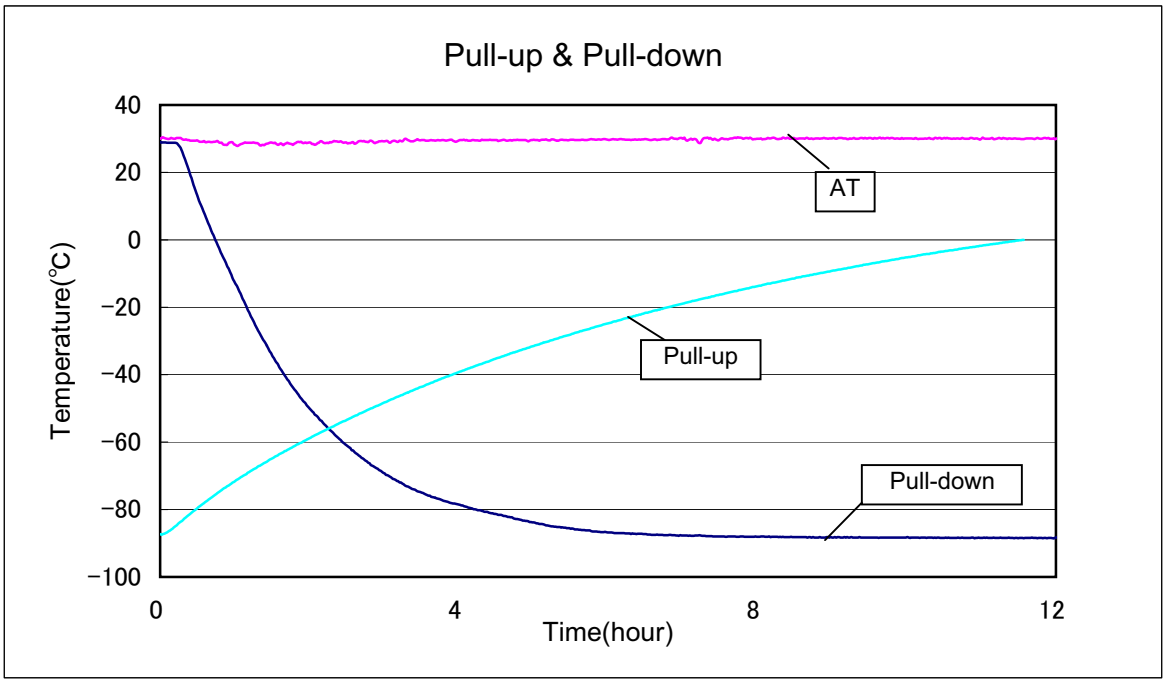


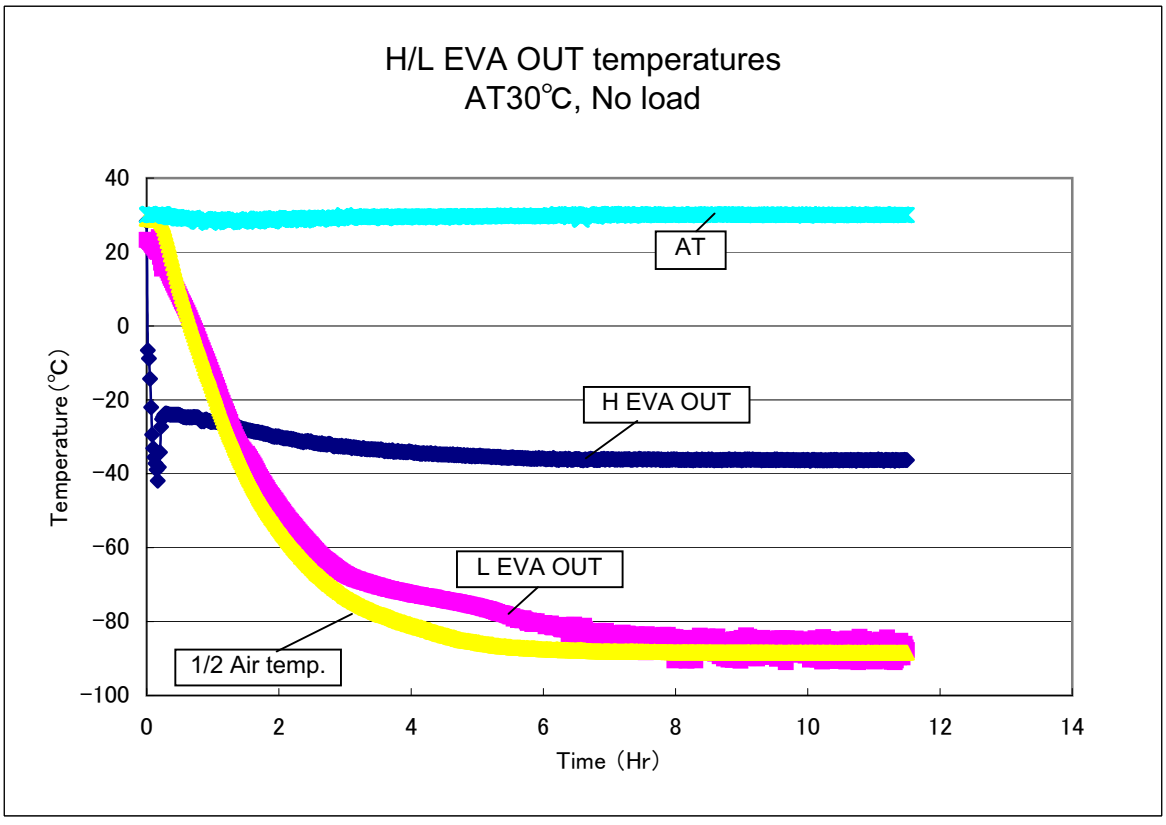
【Unit Base】

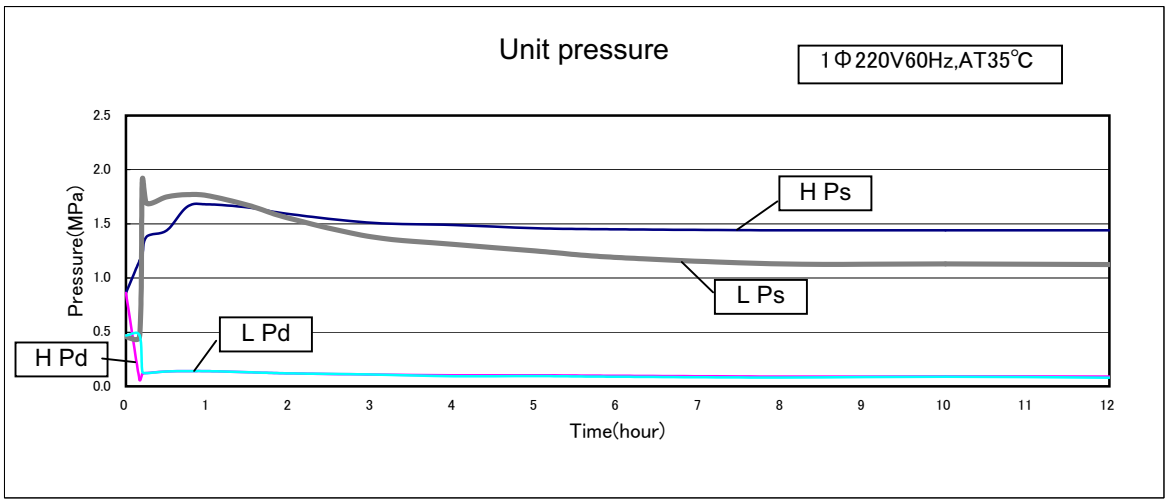


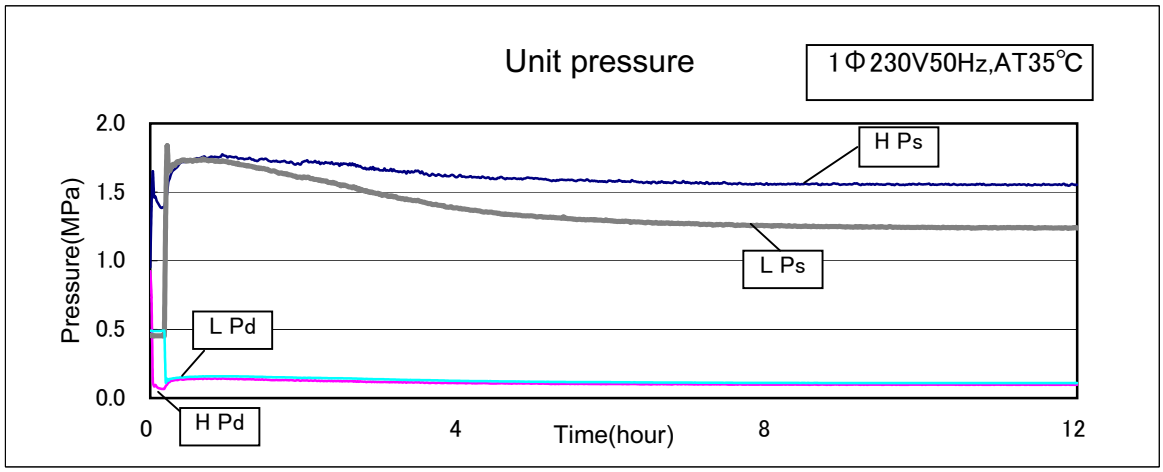
Test data

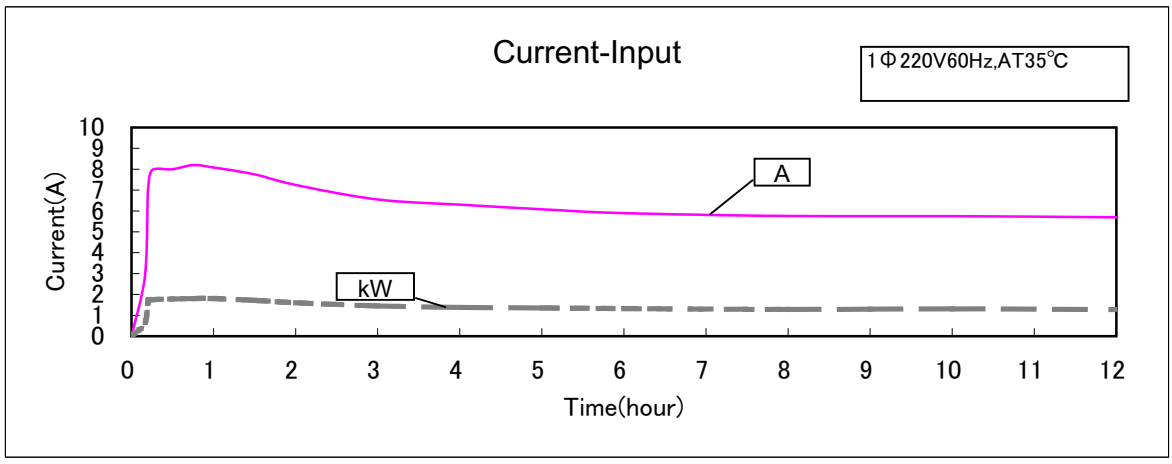
Note) Following data are the reference only.

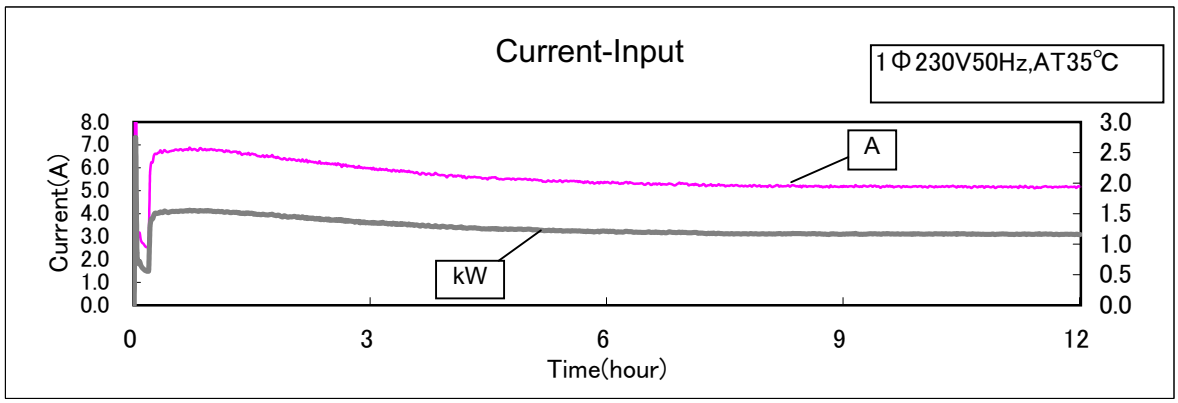





Unit pressure
1Φ220V60Hz,AT35℃
Pressure(MPa)
Time(hour)
H Ps
L Ps
L Pd
H Pd

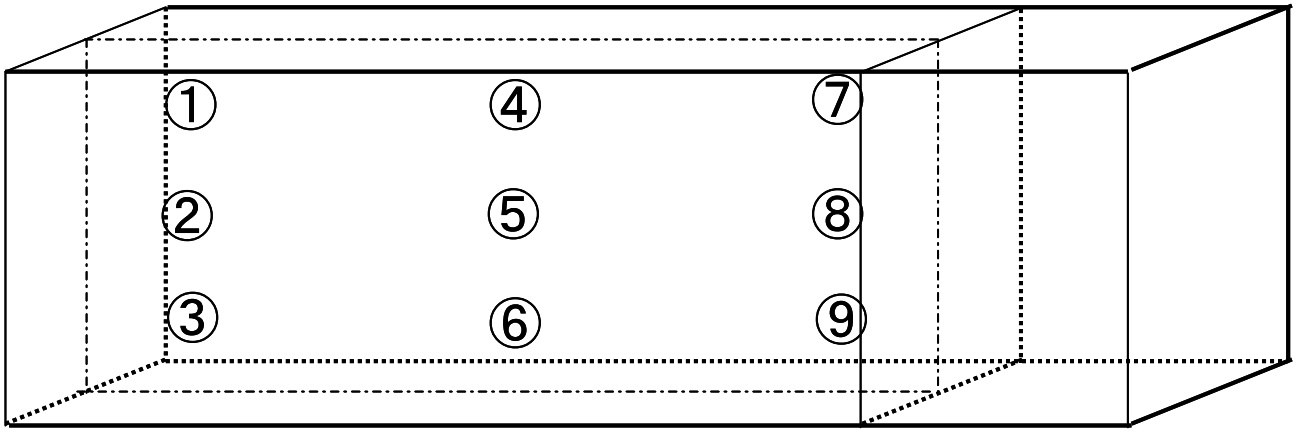

Unit pressure
1Φ230V50Hz,AT35℃
Pressure(MPa)
Time(hour)
H Ps
L Ps
L Pd
H Pd


Current-Input
1Φ220V60Hz,AT35℃
Current(A)
Time(hour)
A
kW


Current-Input
1Φ230V50Hz,AT35℃
Current(A)
Time(hour)
A
kW

Temperature uniformity

Condition
AT=30℃
50Hz
SV=−80℃

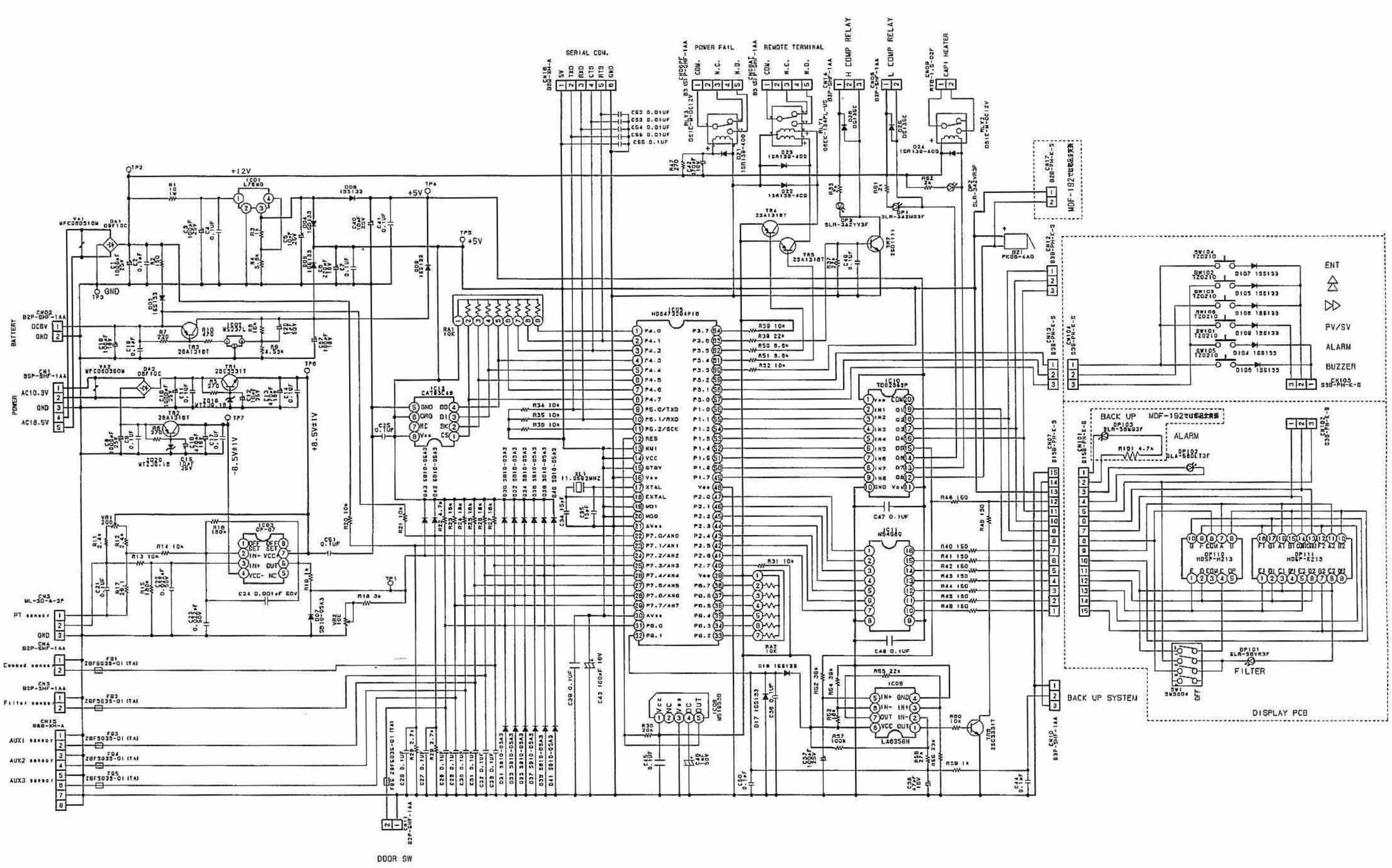


Unit:℃

Measuring point	①	②	③	④	⑤	⑥	⑦	⑧	⑨
Temp.(℃)	−76.0	−77.8	−78.2	−76.2	−78.7	−78.5	−76.8	−77.9	−77.8

<Note> 1 Point ⑤ is measured in 1/2 Air temperature.
2 All points except for ⑤ are measured in 100mm of depth and width of each corner.
3 Operation ratio = Approx. 56% (L side compressor ON; 13.3min. OFF; 10.3min.)

Circuit diagram



Connections on PCB

The following shows connections of connector on Temp. Control PCB.

Connector	Connects to	Usage	Voltage
CN1	#1 - #2: Power transformer	To supply the power to PCB.	#1-#2: AC10.3V #3: GND #4-#5: AC18.5V
CN2	#1 – #2: Battery	To supply the power to alarm during power failure	#1: DC6V #2: GND
CN3	#1 - #3: Temp. sensor	To detect internal temperature	
CN4	#1 - #2: Cascade sensor	To detect cascade temperature	
CN5	#1 - #2: Filter sensor	To detect temperature at condenser outlet pipe	
CN6	#1 - #5 Remote alarm terminal	To output remote alarm	
CN7	Display PCB	To connect with each LED	
CN8	#1 - #2: Temp. control relay L	To control internal temperature	#1 - #2: 12VDC
CN9	#1: Cap. tube heater #2: Power supply line	To supply the power to cap. tube heater	
CN13	Control PCB	To connect with each switches	
CN14	#1 - #3: Temp. control relay H	To control compressor H	
CN15	#1 - #2: A. T. sensor	To detect ambient temperature	

Control specifications

1. Key and Switch

BUZZER : In alarm condition, buzzer stops sounding with this key pressed. Remote alarm output and alarm message would not be off.

ALARM : With this key pressed to activate alarm test mode and unit is forcibly stepped into alarm condition. (ALARM lamp blinks and intermittent buzzer sounds).

PV/SV : Press this key once to activate set mode (2nd digit in LED blinks), press the key again to revert to current internal temperature (PV) display.

▶▶ During set mode, shift between the 1st digit and the 2nd digit. In PV display, press the key over 5 seconds to display filter sensor temperature for 3 seconds. (digit of decimal point is not displayed)
In PV display, press the key 5 times in 5 seconds to turn capillary heater on for the specified time at usual operation.

▲▲ During set mode, count the blinking digit up. In PV display, press the key over 5 seconds to enter the function mode. ("F00" is displayed)
In PV display, press the key for 5 times in 5 seconds to display the value of decimal point for 3 seconds. (Ex. -80.3℃ → 803)

ENTER : During set mode, press the key to store the displayed temperature as set value (SV).
In PV display, press the key 5 times in 5 seconds to display cascade sensor temperature for 3 seconds.

2. Temperature control

Setting range : -20℃～-95℃
Display range : -170℃～+50℃
Setting procedure : Press PV/SV key and set the required value with ▲▲ key and ▶▶ key. Press ENTER key to memorize the value in non-volatile memory.
Out of setting range : If you input the value out of setting range to press ENTER key, the input value would not be entered with continuous buzzer beeps. (1 second)
Note) if you press PV/SV key instead of ENTER key, set value would not be stored and automatically revert to PV display.

3. High temperature alarm

Setting range : +10℃ or +15℃ selectable
Setting procedure : Input F01 and press ENTER key to blink the 1st digit. '000' (initial set, +10℃) is displayed. Input '001' to change setting to 15℃. Press ENTER key to store the value in non-volatile memory.

4. Function mode

Setting range : 00~32
Display range : 00~39
00, 02, 04, 05, 08, 12~14, 18, 19, 23, 26~30 and 33~39 are not used.
Setting procedure : In PV display, keep pressing ▲▲ key over 5 seconds to enter function mode (F00 is displayed). Change the blinking 1st digit to desired function code with ▲▲ key and ▶▶ key. Press ENTER key to be function code available.
If you try to input unused function code and press ENTER key, automatically revert to PV display.

Out of setting range : Even If you input the value out of setting range and press ENTER key, the value would not be entered and automatically revert to PV display.
(Applied for function #: 33~39)
Note) If you press PV/SV key with any function mode displayed, the displayed value is ignored and automatically reverts to PV display.

5. Warning function

High temp. alarm : When PV is reached to SV+SV_H (high temp. alarm SV) +1 or, ALARM lamp and LED display blinks, intermittent buzzer beeps with approx. 12 minutes of delay and remote alarm output turns on.
When PV is reached to SV+ SV_H or lower, ALARM lamp and LED display go off, buzzer stops beeping and remote alarm output turns off.
If you press BUZZER key, the buzzer stops beeping instead remote alarm output does not turn off.
You can set SV_H at 10℃ in F01.

Filter alarm : When the filter sensor temperature is reached to 45℃ or higher, FILTER lamp is flash and the buzzer beeps intermittently.
When the filter sensor temperature is reached to 41℃ or lower, FILTER lamp goes off and buzzer stops beeping.

6. Other function

Cascade control : When the cascade temperature is reached to -34℃ or lower during pull-down, Compressor L would be turned ON.
When the cascade temperature is reached to -18℃ or higher during pull-up, Compressor H would be turned OFF.

Auto return : If there is not any key operation for 90 seconds in SV set mode and function code set mode, automatically reverts to PV mode.
Note) Auto return is not worked in F09 and F10.

7. Function mode

F00 Automatically revert to PV display
F01 SV_H (high temp. alarm SV) setting
F03 Indication of battery accumulation time
F02, F04, F05 Automatically revert to PV display
F06 Service code input (code: 384)
F07 Temperature Zero Adjustment
F08 Automatically revert to PV display
F09 (Factory test mode …… Unused)
F10 (Factory test mode …… Unused)
F11 (Cascade temperature Zero Adjustment …… Unused)
F12~F14 Automatically revert to PV display
F15 Indication of temperature in AT sensor
F16 (Timer speed-up mode …… Unused)
F17 Model code setting (non-volatile memory initialization …… Unused)
F18, F19 Automatically revert to PV display
F20 Capillary heater is forcibly turned off
F21~F23 Automatically revert to PV display
F24 PV display (decimal point is displayed)
F25 Setting of alarm resume time
F26~F30 Automatically revert to PV display
F31 Buzzer setting during filter alarm
F32 Indication of fan motor accumulation time
F33~F39 Automatically revert to PV display

Setting procedure: In PV display, keep pressing ▲▲ key over 5seconds to display “F00”.
Input the desired function code with ▲▲ key and ▶▶ key.
Press ENTER key to be function mode available.
Note) You should input service code in F06 prior to use F07, F09~11, F15~17, F20~22, F24 and F31.
To cancel service code, input “000” in F06 or turn the power off.

F00: <Purpose> Simply passing through if entered by mistake.
<Operation> Press ENTER key in “F00” displayed to revert to PV display..

F01: <Purpose> SV_H (high temp. alarm SV) setting
<Operation> Input F01 and press ENTER key to display “000” (initial value).
Set selectable “000” or “001” with ▲▲ key. Press ENTER key to store the value and revert to PV display.

F02: <Purpose> Simply passing through if entered by mistake.
<Operation> Press ENTER key in “F02” displayed to revert to PV display.

F03: <Purpose> To indicate battery accumulation time. The battery is used for lamp and buzzer operation during power failure.
<Operation> Input F03 and press PV/SV key to display battery accumulation time and “F03” alternately.
<Cancel> Input PV/SV key again to revert to PV display.

F04,05: <Purpose> Simply passing through if entered by mistake.
<Operation> Press ENTER key in “F04” (F05) displayed to revert to PV display..

F06: <Purpose> Dividing F-code for customer used from service
<Operation> Input F06 and press ENTER key to display “000” (initial value).
Set to “384” with ▲▲ key and ▶▶ key. Press ENTER key to store the value and revert to PV display.
<Cancel> Input F06 and press ENTER key to display “384”.
Change to “000” with ▲▲ key and ▶▶ key. Press ENTER key to store the value and revert to PV display.
Turn the power off then on to revert to “000”. (not stored in non-volatile memory)
Note) “384” is stored in non-volatile memory during battery back-up. (battery SW is ON)

<How to reset battery (fan motor) accumulation time>
Input F06 and press ENTER key. Input ‘409’ (‘419’ for fan motor) and press ENTER key again to reset battery (fan motor) accumulation time to show ‘000’ in F03 (F32).

F07: <Purpose> To match controlled temperature of temp. sensor with 1/2air temp.
<Operation> Input F07 and press ENTER key to display “000” (initial value).
Change to the desired value (-99~099) with ▲▲ key and ▶▶ key.
Press ENTER key to store the value and revert to PV display.
Input service code in F06 prior to use this mode.

F08: <Purpose> Simply passing through if entered by mistake.
<Operation> Press ENTER key in F08 displayed to revert to PV display.

F12~14: <Purpose> Simply passing through if entered by mistake.
<Operation> Press ENTER key in F12~14 displayed to revert to PV display.

F15: <Purpose> To indicate temperature in AT sensor
<Operation> Input F15 and press PV/SV key to display F15 and 'XXX' (present AT sensor temperature) alternately.
<Cancel> Press PV/SV key to revert to PV display.

F18~19: <Purpose> Simply passing through if entered by mistake.
<Operation> Press ENTER key in F18~F19 displayed to revert to PV display.

F20: <Purpose> To turn capillary tube heater forcibly off
<Operation> In F20 display, press ENTER key to display "000" (initial value). Change the value to "001" and press ENTER key again to turn capillary tube heater forcibly off. Unit reverts to PV display automatically.
Service code should be input in F06 prior to use this mode.

F21~23: <Purpose> Simply passing through if entered by mistake.
<Operation> Press ENTER key in F21~F23 displayed to revert to PV display.

F24: <Purpose> PV is displayed in 3 digits (digit of decimal point is displayed)
<Operation> In F24 displayed, press ENTER key to display "000" (initial value)
Change the value to "001" with ⏫ key and press ENTER key.
Ex.) -85.1℃ → 851
Service code should be input in F06 prior to use this mode.

F25: <Purpose> Setting of alarm resume time
<Operation> Input F25 and press ENTER key to display "100" (initial value).
Change the value with ⏫ key and ⏩ key.
Press ENTER key to store the value and revert to PV display.
Settable range is between 10 and 60 min. with 1 min. increment.

If you set selectable following code with BUZZER key pressed, both buzzer and remote alarm relay are turned OFF;
000: Buzzer and remote alarm don't resume
010: Buzzer and remote alarm resume with 10min. later
020: Buzzer and remote alarm resume with 20min. later
030: Buzzer and remote alarm resume with 30min. later (initial set)
040: Buzzer and remote alarm resume with 40min. later
050: Buzzer and remote alarm resume with 50min. later
060: Buzzer and remote alarm resume with 60min. later

if you set selectable following code with BUZZER key pressed, only buzzer is turned OFF;
100: Buzzer doesn't resume
110: Buzzer resumes with 10min. later
120: Buzzer resumes with 20min. later
130: Buzzer resumes with 30min. later
140: Buzzer resumes with 40min. later
150: Buzzer resumes with 50min. later
160: Buzzer resumes with 60min. later

F26~30: <Purpose> Simply passing through if entered by mistake.
<Operation> Press ENTER key in F26~F30 displayed to revert to PV display.

F31: <Purpose> Buzzer setting during filter alarm
<Operation> In F31 displayed, press ENTER key to display “001” (initial value). Change to “000” with ▲▲ key and press ENTER key to be FILTER lamp lit during filter alarm. Service code should be input in F06 prior to use this mode.
001: Alarm lamp flashes and the buzzer beeps intermittently
000: Alarm lamp is lit

F32: <Purpose> To indicate accumulation time of condensing fan motor for compressor cooling.
<Operation> Input F32 and press PV/SV key. F32 and accumulation time (Ex.“000”) are alternately displayed. If you press ENTER key, the unit reverts to PV display.
<Cancel> Press PV/SV key to revert to PV display.

F33~39: <Purpose> Simply passing through if entered by mistake.
<Operation> Press ENTER key in F33~F39 displayed to revert to PV display.

8. Differential (The point in which compressor turns ON and OFF)

COMP ON: SV +0.5℃
COMP OFF: SV -0.8℃

9. Temperature offset

The difference between the temperature in temp. sensor and center temperature of the chamber should be adjusted by temperature offset.
Offset value; PV - 2.0℃

10. Remote alarm

(1) High temp. alarm (RLY 1)
In normal condition: Remote alarm contact is N.O. N.C.
↓ ↓
In alarm condition: Remote alarm contact is N.C. N.O.

(2) Power failure alarm (RLY 3)
In normal condition: Remote alarm contact is N.O. N.C.
↓ ↓
In power failure: Remote alarm contact is N.C. N.O.

11. Sensor failure

(1) Temp. sensor

Open circuit: E01 and 50℃ are displayed alternately, the buzzer beeps intermittently and remote alarm contact outputs.
The compressor would be allowed to turn on.
Press BUZZER key to stop the buzzer beeping.

Short circuit: E02 and -170 ℃ are displayed alternately, the buzzer beeps intermittently and remote alarm contact outputs.
The compressor would be allowed to turn on.
Press BUZZER key to stop the buzzer beeping.

(2) Cascade sensor

Open circuit: E03 and PV are displayed alternately, the buzzer beeps intermittently and remote alarm contact outputs. The resistance value would be limitless that makes the temperature -34 ℃ or lower. At the time compressor (L) is not forcibly turned off.
Press BUZZER key to stop the buzzer beeping.

Short circuit: E04 and PV are displayed alternately, the buzzer beeps intermittently and remote alarm contact outputs. The resistance value would be “0” that makes the temperature -18℃ or higher to detect an error.
Compressor (L) is forcibly turned off.
Press BUZZER key to stop buzzer beeping.

(3) Filter sensor

Open circuit: E05 and PV are displayed alternately, the buzzer beeps intermittently and remote alarm contact outputs.
Press BUZZER key to stop the buzzer beeping.

Short circuit: E06 and PV are displayed alternately, the buzzer beeps intermittently and remote alarm contact outputs.
Press BUZZER key to stop the buzzer beeping.

(4) AT sensor

Open circuit: E07 and PV are displayed alternately, the buzzer beeps intermittently and remote alarm contact outputs.
Press BUZZER key to stop the buzzer beeping.

Short circuit: E08 and PV are displayed alternately, the buzzer beeps intermittently and remote alarm contact outputs.

(5) Error code priority

No.1: Temp. sensor failure (E01 or E02)
No.2: Filter sensor failure (E05 or E06)
No.3: AT sensor failure (E07 or E08)
No.4: Condenser abnormal temperature (E10) … Compressor (H) is locked

(4) Error diagnosis

E01: When PT sensor detects 50.0℃ or higher , it regards as open circuit.
E02 : When PT sensor detects -170℃ or lower, it regards as short circuit.
E05 : When filter sensor detects -50℃ or lower, it regards as open circuit.
E06 : When filter sensor detects 70℃ or higher, it regards as short circuit.
E07: When AT sensor detects -50℃ or lower, it regards as open circuit.
E08: When AT sensor detects 70℃ or higher, it regards as short circuit.
E10: When filter sensor detects 60℃ or higher, it regards as open circuit.
When filter sensor detects equal or lower than AT sensor temperature +10℃, E10 is cancelled to display.

12. Cycle operation for capillary tube heater

Cycle: Capillary tube heater turns on once every 12 hours
Operation time: 8 minutes
Timing: Capillary tube heater turns on regardless of compressor (L).
Compressor (L) is turned off at that time.

13. Compressor operation when the power is supplied (battery unattached)

Compressor (H): Once the power is supplied, compressor (H) is forcibly turned on regardless of PV.
When filter sensor detects 60℃ or higher, compressor (H) is forcibly turned off. This function is ineffective when E05 or E06 is displayed.

Compressor (L): When PV is higher than SV+0.5℃ and cascade sensor detects -34℃ or lower, the compressor (L) turns on with 2minutes (initial value) of delay after the power was supplied.
When PV is higher than SV+0.5℃ and cascade sensor detects -34℃ or higher, the compressor (L) turns on with 2minutes (initial value) of delay after the power was supplied.

Setting data: The setting data initialized in F17 is retrieved in non-volatile memory.

14. Lamp and buzzer

(1) Control PCB

DP1: Green lamp
When the compressor (L) is OFF, DP1 goes off. (normal status)
When the compressor (L) is ON, DP1 is lit.

DP2: Red lamp
When the capillary tube heater is OFF, DP2 goes off. (normal status)
When the capillary tube heater is ON, DP2 is lit.

DP3: Yellow lamp
Lit continuously
When the compressor (H) is ON, DP3 is lit. (normal status)
When the compressor (H) is OFF, DP3 goes off.

(2) Display PCB

DP102: Red lamp
When the unit is not in high temp. alarm condition, DP102 goes off.
When the unit is in high temp. alarm (without delay), or sensor failure, or power failure, or door open, DP102 is lit.

DP101: Red lamp
When the unit is not in filter alarm condition, DP101 goes off.
When the unit is in filter alarm condition, DP101 is lit or flash.

(3) Buzzer

High temp. alarm:	Intermittent tone with 12minutes of delay
Sensor failure:	Intermittent tone when EXX (XX=01~08, 10) is displayed
Power failure:	Intermittent tone
Key quick:	Short tone if key quick is available
Out of input range:	1second continuous tone

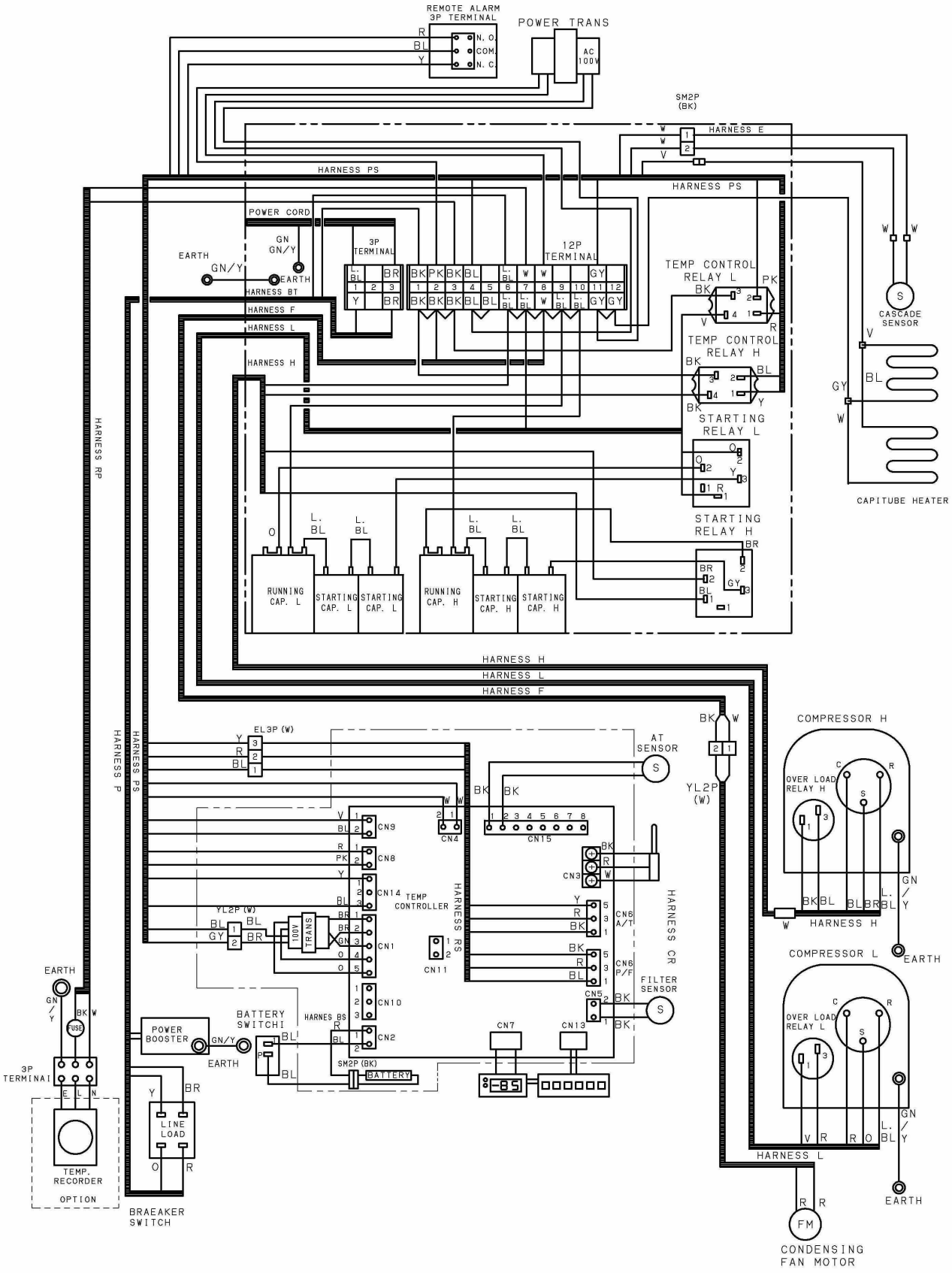
15. Notice of timing for replacing battery/fan motor (F1: Battery F2: Fan motor)

(1) In F03 mode, “F1” and PV are alternately displayed when the battery accumulation time is “028” (2.8 years) or higher.

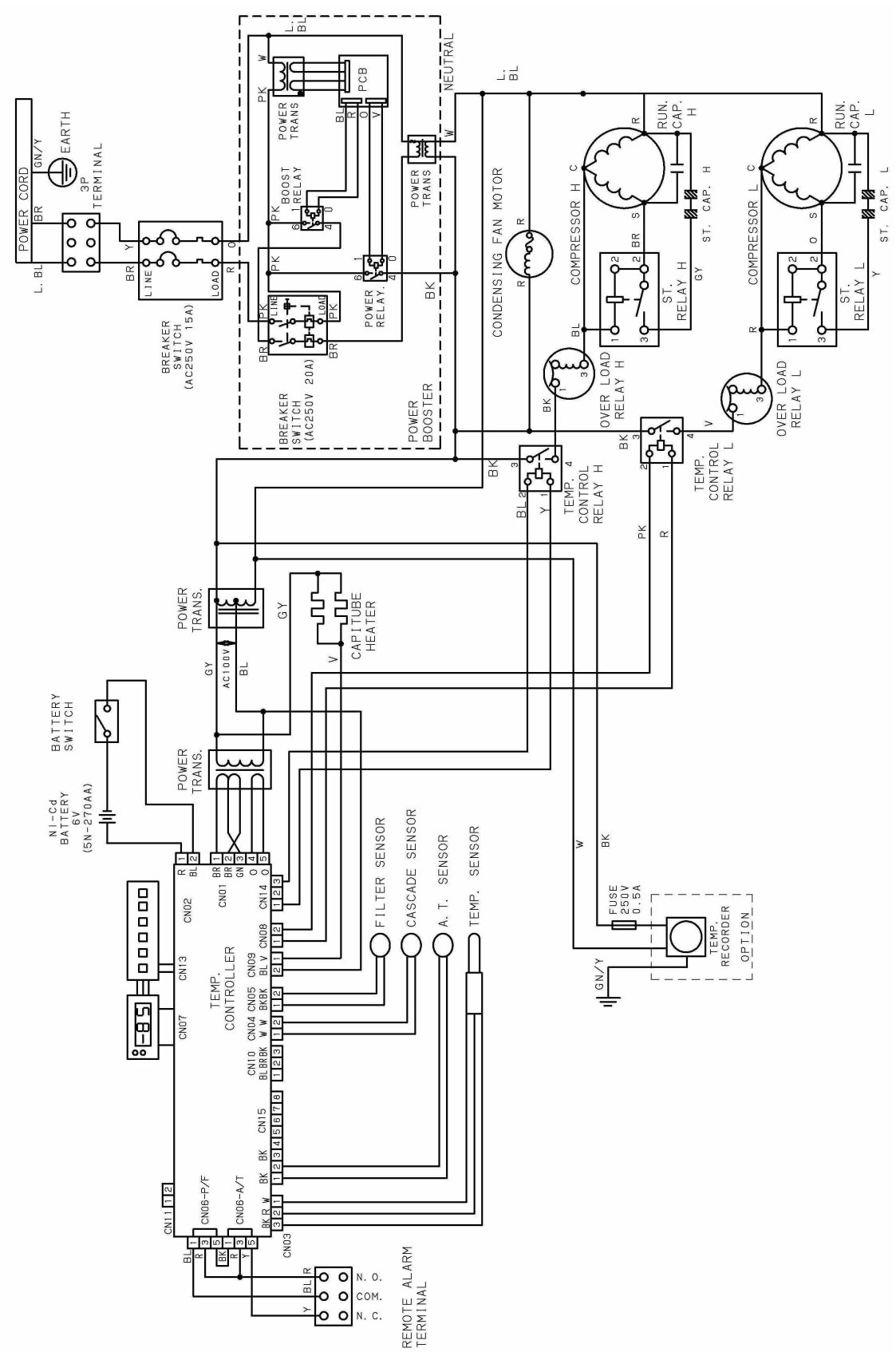
(2) In F32 mode, “F2” and PV are alternately displayed when the fan motor accumulation time is “056” (5.6 years) or higher.

Note: You must reset battery/fan motor accumulation time in F06 after you replace them.
See page 18 how to reset.

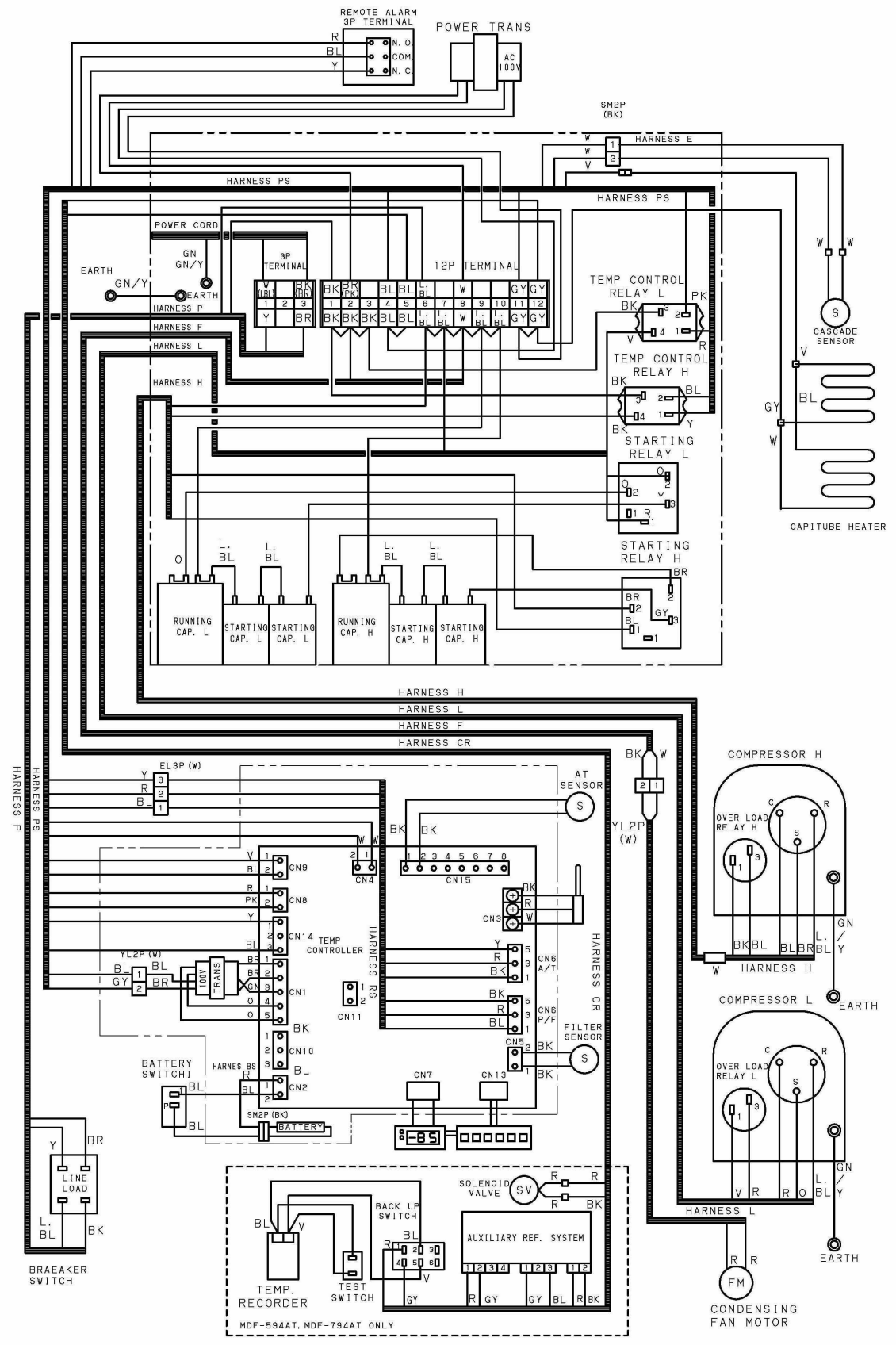
〈MDF-794c〉


REMOTE ALARM 3P TERMINAL
POWER TRANS
AC 100V
SM2P (BK)
HARNESS E
HARNESS PS
POWER CORD
EARTH
GN GN/Y
3P TERMINAL
12P TERMINAL
HARNESS BT
HARNESS F
HARNESS L
HARNESS H
HARNESS RP
TEMP CONTROL RELAY L
TEMP CONTROL RELAY H
STARTING RELAY L
STARTING RELAY H
CASCADE SENSOR
CAPITUBE HEATER
RUNNING CAP. L
STARTING CAP. L
STARTING CAP. L
RUNNING CAP. H
STARTING CAP. H
STARTING CAP. H
EL3P (W)
AT SENSOR
YL2P (W)
COMPRESSOR H
OVER LOAD RELAY H
COMPRESSOR L
OVER LOAD RELAY L
CN9
CN8
CN14
CN1
CN10
CN2
CN4
CN15
CN3
CN6 A/T
CN6 P/F
CN5
CN11
CN7
CN13
TEMP CONTROLLER
HARNESS RS
HARNESS CR
FILTER SENSOR
BATTERY SWITCHI
HARNES BS
SM2P (BK)
BATTERY
POWER BOOSTER
FUSE
3P TERMINAI
TEMP. RECORDER
OPTION
LINE LOAD
BRAEAKER SWITCH
FM
CONDENSING FAN MOTOR

〈MDF-794c〉

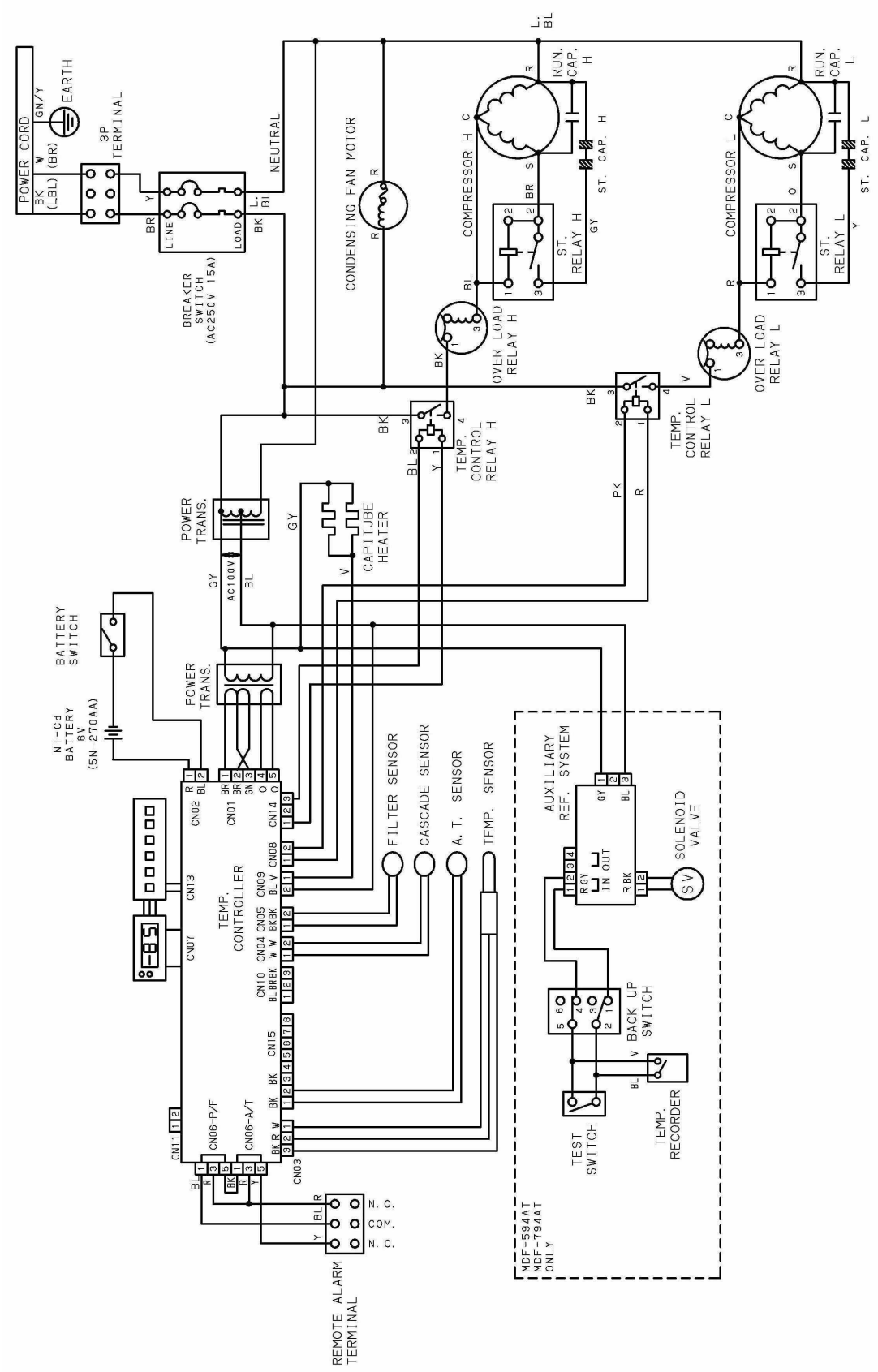

POWER CORD
EARTH
3P TERMINAL
BREAKER SWITCH (AC250V 15A)
BREAKER SWITCH (AC250V 20A)
POWER BOOSTER
PCB
POWER TRANS
BOOST RELAY
POWER RELAY
NEUTRAL
CONDENSING FAN MOTOR
COMPRESSOR H
COMPRESSOR L
RUN. CAP. H
RUN. CAP. L
ST. RELAY H
ST. RELAY L
ST. CAP. H
ST. CAP. L
OVER LOAD RELAY H
OVER LOAD RELAY L
TEMP. CONTROL RELAY H
TEMP. CONTROL RELAY L
CAPITUBE HEATER
BATTERY SWITCH
Ni-Cd BATTERY 6V (5N-2270AA)
TEMP. CONTROLLER
FILTER SENSOR
CASCADE SENSOR
A. T. SENSOR
TEMP. SENSOR
FUSE 250V 0.5A
TEMP. RECORDER
OPTION
REMOTE ALARM TERMINAL
N. O.
COM.
N. C.

〈MDF-794/793(N)〉


REMOTE ALARM 3P TERMINAL
POWER TRANS
AC 100V
SM2P (BK)
HARNESS E
HARNESS PS
POWER CORD
EARTH
3P TERMINAL
12P TERMINAL
HARNESS P
HARNESS F
HARNESS L
HARNESS H
TEMP CONTROL RELAY L
TEMP CONTROL RELAY H
STARTING RELAY L
STARTING RELAY H
CASCADE SENSOR
CAPITUBE HEATER
RUNNING CAP. L
STARTING CAP. L
STARTING CAP. L
RUNNING CAP. H
STARTING CAP. H
STARTING CAP. H
HARNESS CR
EL3P (W)
AT SENSOR
YL2P (W)
COMPRESSOR H
OVER LOAD RELAY H
COMPRESSOR L
OVER LOAD RELAY L
EARTH
TEMP CONTROLLER
HARNESS RS
CN1
CN2
CN3
CN4
CN5
CN6 A/T
CN6 P/F
CN7
CN8
CN9
CN10
CN11
CN13
CN14
CN15
FILTER SENSOR
BATTERY SWITCH
BATTERY
SOLENOID VALVE
SV
BACK UP SWITCH
AUXILIARY REF. SYSTEM
TEMP. RECORDER
TEST SWITCH
MDF-594AT, MDF-794AT ONLY
LINE LOAD
BRAEAKER SWITCH
FM
CONDENSING FAN MOTOR

Wiring diagram

〈MDF-794/793(N)〉



Specifications

■Structural specifications

Model	MDF-794	MDF-793(N)	MDF-794C
Name	Ultra-low Temperature Freezer		
External dimensions	W2570 × D770 × H1070 (mm)		
Internal dimensions	W1840 × D500 × H762 (mm)		
Effective capacity	701 L		
Exterior	Painted steel		
Interior	Stainless steel		
Outer door	Painted steel		
Inner door	4 pcs.		
Caster	6 pcs. (3 leveling legs)		
Insulation	Rigid polyurethane foamed-in place		
Monitoring hole	On left side, ID;φ40mm		
Compressor	High stage side; 1100W Low stage side; 1100W		
Evaporator	High stage side; Cascade condenser Low stage side; Tube on sheet (Sharing with interior)		
Condenser	High stage side; Fin and tube type Low stage side; Cascade condenser		
Refrigerant	High stage side; R407D Low stage side; R-508		
Refrigerating oil	Ze-NIUS32SA		
Power supply	Local voltage		
Battery	For power failure alarm; Nickel-cadmium battery DC6V, 270mAh		
Weight	335 kg	335 kg	347 kg
Power booster	None		1 pc
Back-up system	None		
Accessories	1 set of key, 1 scraper		
Option	Aluminum container; MDF-59SC Inventory rack; IR213C, IR309C Temperature recorder; MTR-85H Back-up system; CVK-UB2, CVK-UB2(I): LCO_2		

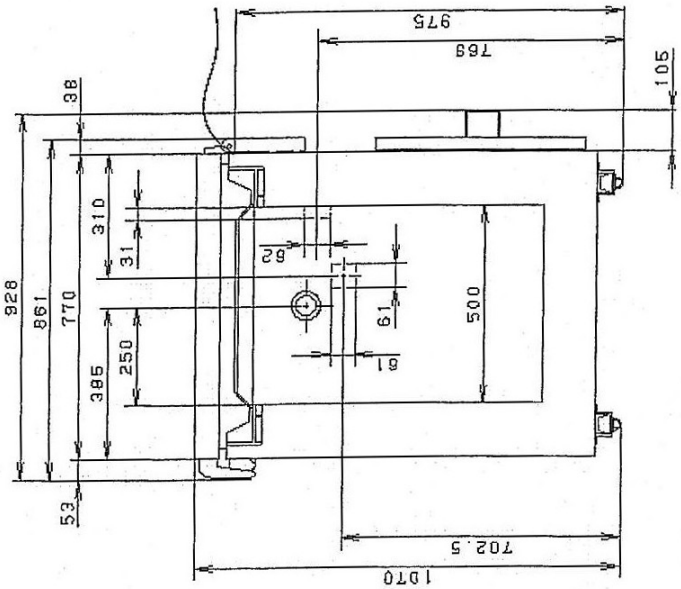
■Control specifications

Model		MDF-794/793(N)/794C
Cooling performance		Center part of freezing room; -85℃（AT+30℃, no load）
Temperature controller		Microprocessor control system Setting range; -20 ~ -95℃ (Unit;1℃) Setting value is kept in non-volatile memory
Temperature sensor		Pt.100Ω
Temperature display		LED digital display (Unit;1℃)
Alarm	High temp.	Setting range; Selectable +10℃ or +15℃（Initial; +10℃） ALARM lamp flashes and intermittent buzzer tone is emitted with 12min. delay Remote alarm contact; Normal Open, Normal Close Rated contact capacity; Max. DC30V、2A Contact turns over with 12min. of delay Auto recovery
	Filter check	FILTER lamp flashes and intermittent buzzer tone is emitted to inform the condenser filter clogged.
	Power failure	At power failure and power cord is disconnected, ALARM lamp flashes, intermittent buzzer tone is emitted and remote alarm contact turns over.
	Remote alarm	Remote alarm terminal; 3P: Max. DC30V, 2A NC-COM, NO-COM
	Battery accumulation	Accumulation time; Approx. 3 years Present temperature and F1 are alternately displayed without buzzer tone emitted and remote alarm terminal activated
	Fan motor accumulation	Accumulation time; Approx. 6 years Present temperature and F2 are alternately displayed without buzzer tone emitted and remote alarm terminal activated
Control panel		Lamp; ALARM, FILTER Alarm buzzer stop key; BUZZER Power switch; POWER Battery switch Mode setting key; PV/SV Enter key; ENTER Digit shift key; ▶▶ Numerical value shift key; ▲ Alarm test key; ALARM
Self diagnosis function		When any error is occurred in chamber temperature, filter sensor, cascade sensor and AT sensor, error code and PV are alternately displayed. ALARM lamp flashes, remote alarm contact turns over and intermittent buzzer tone emitted.
Compressor protection		When cascade sensor is equal or lower than -34℃, low stage side compressor turns ON. When cascade sensor is equal or higher than -18℃, low stage side compressor turns OFF. When filter sensor is equal or higher than +60℃, high stage side compressor turns OFF. When filter sensor is equal or lower than AT sensor temperature + 10℃, high stage compressor turns ON. Overload relay

■Performance specifications

Cooling performance	Center part of freezing room; -86℃（AT30℃, no load）			
Temperature control range	-20℃～-86℃			
Power source	220V, 50Hz	220V, 60Hz	230V, 50Hz	240V, 50Hz
Rated power consumption	1070W	1210W	1100W	1130W
Noise level	50dB <A> (background noise; 20dB)			
Maximum pressure	1.8 MPaG			

Dimensions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250
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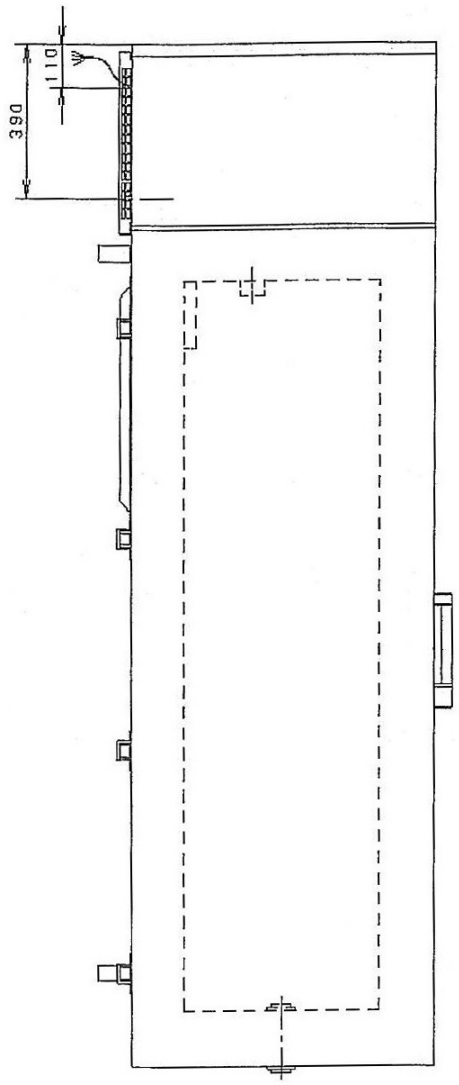
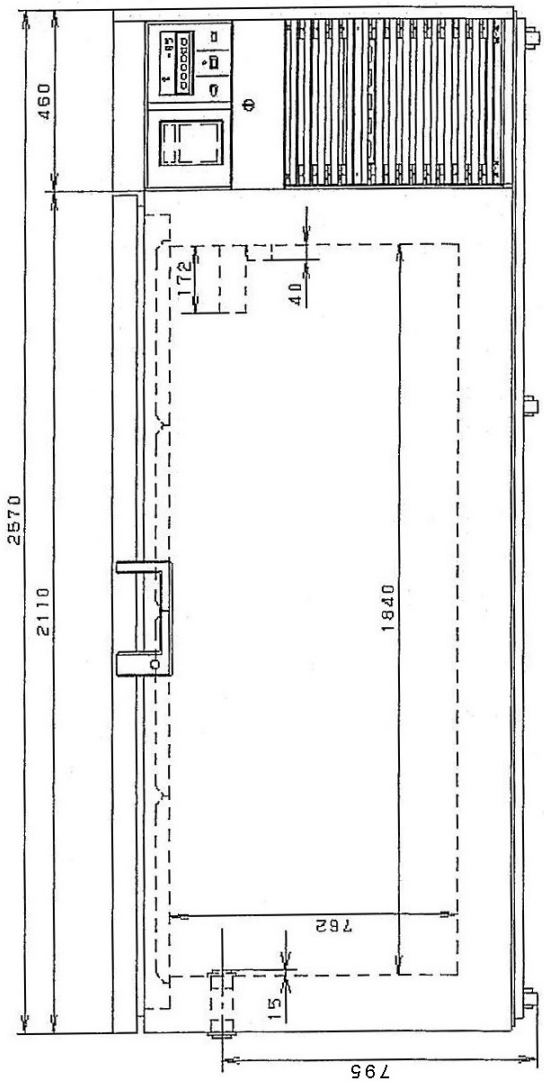
702.5
1070


110
390

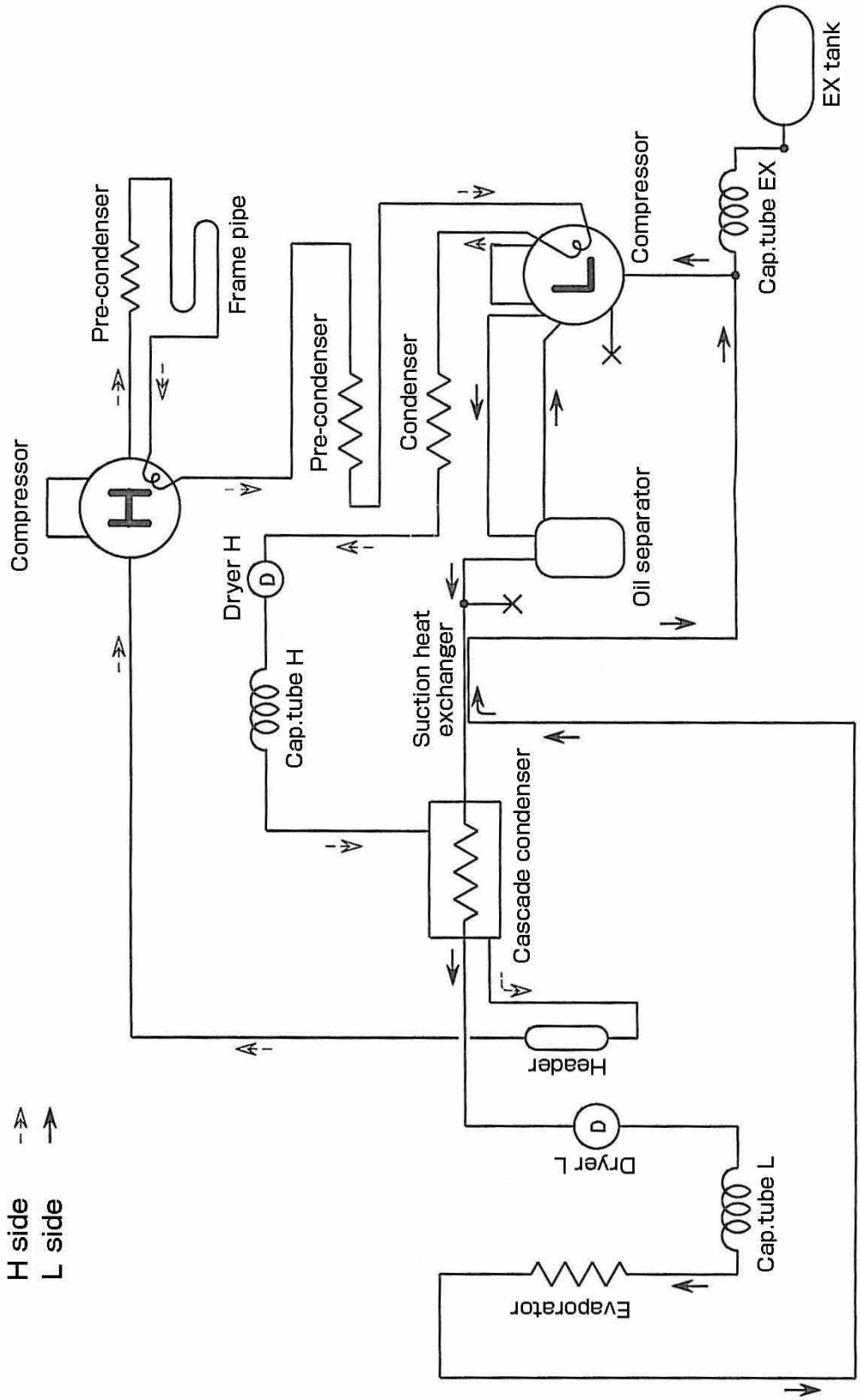

460
172
40
2570
2110
1840
762
15
795

Cooling unit parts

<MDF-794/793(N)/794C>

Item	Specifications		
	H side	L side	
Compressor			
220V, 50Hz	Type: KS370J1NS-4A Compressor code: 7FB-0-M101-001-04		
220V, 60Hz	Type: KS370J1NS-7A Compressor code: 7FB-0-M101-001-06		
230/240V, 50Hz	Type: KS370J1NS-4A1 Compressor code: 7FB-0-M101-001-05		
Refrigerant oil	Ze-NIUS32SA Charged q'ty: 850cc	Ze-NIUS32SA Charged q'ty: 850cc	
Cooling system	Forced air cooling（partially） Oil cooler	Forced air cooling（partially） Oil cooler	
Condenser			
Type	Fin and tube	Cascade condenser	
Condenser	12 columns x 3 lines P4mm Fin 78pcs.	Coil pipe ϕ6.35mm	
Pre-condenser	ϕ6.35 x 8 columns W 420mm	——	
Frame pipe	ϕ6.35mm	——	
Evaporator Type	Cascade condenser Shell and tube ϕ80mm x 2	Tube on sheet ϕ9.52	
Capillary tube			EX capillary
Resistance PSI・kg/cm^2	56 PSI/G	78 PSI/G	34 PSI
Length (mm)	1300	3000	500
Outer diameter (mm)	ϕ2.4	ϕ2.4	ϕ2.4
Inner diameter (mm)	ϕ1.2	ϕ1.2	ϕ1.2
Refrigerant	R-407D Charged q'ty: 515g	R-508(TP5R3) Charged q'ty: 295g	
Oil additive	n-Pentane Charged q'ty: 31g	n-Pentane Charged q'ty: 33g	
Dryer	4A-XH-9 Charged q'ty: 18g	4A-XH-6 Charged q'ty: 58g	
Condensing fan	ϕ230 mm、4 blades Material: ABS	——	
Condensing fan motor	Type: SE4-E11L3P Type: FL2-CO21R5MP(for compressor cooling)	——	
Oil separator	——	SPK-0S02S3	

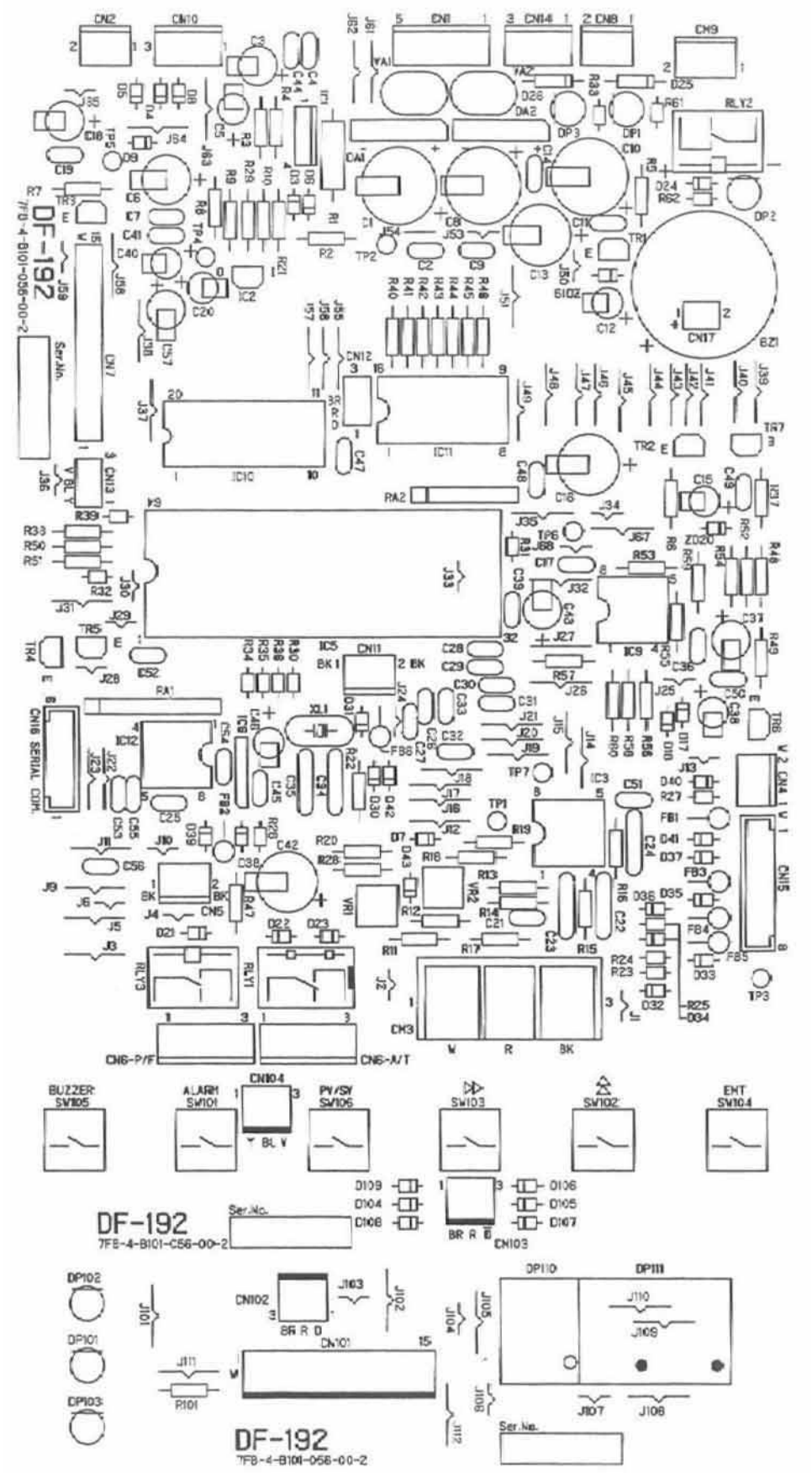
Secondary cooling circuits



Electric parts

MDF-794/793(N)/794C		220V, 60Hz	220V, 50Hz	230/240V, 50Hz
Compressor (H), (L)	Type	KS370J1NS-7A	KS370J1NS-4A	KS370J1NS-4A1
	Parts code	7FB 0 M101 001 06	7FB 0 M101 001 04	7FB 0 M101 001 05
	Rated voltage	220V, 60Hz	220/230V, 50Hz	230/240V, 50Hz
	Winding resistance(C-S)	1.64Ω	2.53Ω	2.53Ω
	Winding resistance(C-R)	3.35Ω	4.8Ω	4.8Ω
Starting relay (H), (L)	Type	AMVL-300A	AMVL-300A	AMVL-300A
	Pick-up voltage	215~247VAC	185~217VAC	185~217VAC
	Drop-out voltage	69~132VAC	60~120VAC	60~120VAC
	Parts code	626 100 1503	626 100 1503	926 100 1504
Overload relay (H), (L)	Type	MST16AG135/69	MST16AJ135/69	MST16AJ135/69
	Action to temp. (no current)	ON:69±10℃ OFF:135±10℃	ON:69±10℃ OFF:135±10℃	ON:69±10℃ OFF:135±10℃
	Action to current (AT25℃)	29.5A	22.5A	22.5A
	Operation time	6~16 sec.	6~16 sec.	6~16 sec.
	Parts code	624 226 3173	624 226 3166	924 226 3167
Starting capacitor (H), (L)	Type	160UF, 250V	100UF, 250V	100UF, 250V
Running capacitor (H), (L)	Type	25UF, 400VAC	25UF, 400VAC	25UF, 400VAC
Condensing fan motor	Type	SE4-E11L5P	SE4-E11L5P	SE4-E11L5P
	Rated voltage	220-240V	220-240V	220-240V
	Parts code	624 224 0167	624 224 0167	924 224 0168
Condensing fan motor (for compressor cooling)	Type	FL2-C021R5MP	FL2-C021R5MP	FL2-C021R5MP
	Rated voltage	220-240V, 2W	220-240V, 2W	220-240V, 2W
	Parts code	624 227 8467	624 227 8467	924 227 8468
Cap.tube heater	Rated voltage	100V, 12W	100V, 12W	100V, 12W
	Resistance(25℃)	833Ω	833Ω	833Ω
	Parts code	624 183 8952	624 183 8952	924 183 8953
Temp. control relay (H)	Type	G4F-11123T	G4F-11123T	G4F-11123T
	Rated voltage	20A, 12VDC	20A, 12VDC	20A, 12VDC
	Parts code	624 173 2397	624 173 2397	924 173 2398
Temp. control relay (L)	Type	G4F-11123T	G4F-11123T	G4F-11123T
	Rated voltage	20A, 12VDC	20A, 12VDC	20A, 12VDC
	Parts code	624 173 2397	624 173 2397	924 173 2398
Breaker switch	Type	BAM215131	BAM215131	BAM215131
	Rated voltage	250V, 15A	250V, 15A	250V, 15A
	Parts code	624 215 4235	624 215 4235	924 215 4236
Power transformer for PCB	Type	A-3578	A-3578	A-3578
	Rated voltage	6.2VA	6.2VA	6.2VA
	Parts code	624 171 0279	624 171 0279	924 171 0280
Power transformer	Type	ATR-C50	ATR-C50	ATR-C50
	Rated voltage	200-240V	200-240V	200-240V
	Parts code	624 006 0408	624 006 0408	924 006 0409
Battery switch	Type	SLE6A2-5	SLE6A2-5	SLE6A2-5
	Rated voltage	4A, 250VAC	4A, 250VAC	4A, 250VAC
	Parts code	624 213 1472	624 213 1472	924 213 1473
Battery	Type	5N-270AA	5N-270AA	5N-270AA
	Rated voltage	6V, 270MAH	6V, 270MAH	6V, 270MAH
	Parts code	624 171 0272	624 171 0272	924 171 0273
Temp. sensor	Type	PT-100Ω	PT-100Ω	PT-100Ω
Cascade sensor	Type	502AT	502AT	502AT
	Rated voltage	5KΩ, 25℃	5KΩ, 25℃	5KΩ, 25℃
Filter sensor	Type	502AT	502AT	502AT
	Rated voltage	5KΩ, 25℃	5KΩ, 25℃	5KΩ, 25℃
AT sensor	Type	502AT	502AT	502AT
	Rated voltage	5KΩ, 25℃	5KΩ, 25℃	5KΩ, 25℃
Power transformer for PCB of Power Booster (MDF-794C only)	Type	ATR-HJ61TC		
	Rated voltage	200V, 225V, 240V		
	Parts code	624 208 1029		
Power transformer for step-up (MDF-794C only)	Type	ATR-D35003		
	Rated voltage	P208V, S230V, 3.3KVA, S13A		
	Parts code	624 226 7621		
Boost relay (MDF-794C only)	Type	DS1E-M-DC12V		
	Rated voltage	12V, 0.6A, 125V		
	Parts code			
Power relay (MDF-794C only)	Type	G7L-1A-TUB		
	Rated voltage	30A, 220V, DC24V		
	Parts code	624 208 1043		
Breaker switch (MDF-794C only)	Type	IR11A2E151R		
	Rated voltage	AC25V, 15A		
	Parts code	624 225 0340		

Components on PCB



Specifications of sensor

■Temperatures in temperature sensor (502AT-1) and resistance values

℃	kΩ	℃	kΩ	℃	kΩ	℃	kΩ
−50	154.5	−36	71.80	−22	35.65	0	13.29
−49	145.9	−35	68.15	−21	33.99	5	10.80
−48	137.8	−34	64.71	−20	32.43	10	8.84
−47	130.2	−33	61.48	−19	30.92	15	7.20
−46	123.1	−32	58.43	−18	29.50	20	6.01
−45	116.5	−31	55.55	−17	28.14	25	5.00
−44	110.2	−30	52.84	−16	26.87	30	4.17
−43	104.4	−29	50.23	−15	25.65	35	3.50
−42	98.87	−28	47.77	−14	24.51	40	2.96
−41	93.70	−27	45.45	−13	23.42	45	2.51
−40	88.85	−26	43.26	−12	22.39	50	2.13
−39	84.18	−25	41.19	−11	21.41	55	1.82
−38	79.80	−24	39.24	−10	20.48	60	1.56
−37	75.67	−23	37.39	−5	16.43	65	1.35

■Temperatures in temperature sensor (PT-100) and resistance values

℃	Ω	℃	Ω	℃	Ω	℃	Ω
−140	43.87	−90	64.30	−40	84.27	10	103.90
−130	48.00	−80	68.33	−30	88.22	20	107.79
−120	52.11	−70	72.33	−20	92.16	30	111.67
−110	56.19	−60	76.33	-10	96.09	40	115.54
−100	60.25	−50	80.31	0	100.00	50	119.40

Effective models

This service manual is effective following models.

Model name	Product code	Voltage and Frequency	
MDF-794	823 002 52	220V	50Hz
	823 002 53	220V	60Hz
	823 002 54	230/240V	50Hz
MDF-793(N)	823 002 56	220V	50Hz
MDF-794C	823 002 80	220V	60Hz

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